

CLAIMS

- Sub (a)
1. A method for reducing bioaccessibility of a heavy metal in metal-contaminated particulate matter, the method comprising the steps of:
treating the particulate matter with a phosphate additive, a chloride additive, and an iron additive;
wetting the additive-containing particulate matter with water;
incubating the wet, additive-containing particulate matter at a temperature above ambient temperature for a time sufficient to reduce the bioaccessibility of the heavy metal.
 2. A method as claimed in Claim 1 wherein the phosphate additive is an ortho-phosphate compound.
 3. A method as claimed in Claim 1 wherein the phosphate additive is selected from the group consisting of triple superphosphate, single superphosphate, phosphoric acid, polyphosphoric acid, monocalcium phosphate, dicalcium phosphate, tricalcium phosphate, monosodium phosphate, disodium phosphate, trisodium phosphate, potassium phosphate, synthetic hydroxyapatite, naturally occurring fluorapatite or hydroxyapatite, and phosphate rock.
 4. A method as claimed in Claim 1 wherein the phosphate additive is added in an amount between about 0.1% and 15% by weight.
 5. A method as claimed in Claim 1 wherein the chloride additive is selected from the group consisting of calcium chloride, ferrous chloride, ferric chloride, aluminum chloride, sodium chloride, potassium chloride, and hydrogen chloride.
 6. A method as claimed in Claim 1 wherein the chloride additive is added in an amount between about 0.1% and 10% by weight.
 7. A method as claimed in Claim 1 wherein the iron additive is selected from the group consisting of elemental iron and an iron compound.

8. A method as claimed in Claim 7 wherein the iron compound is selected from the group consisting of ferrous chloride, ferric chloride, ferrous sulfate, ferric sulfate, ferrous nitrate, ferric nitrate, and iron oxide.

9. A method as claimed in Claim 1 wherein the iron additive is added in an amount between about 0.1% and 15% by weight.

10. A method as claimed in Claim 1 wherein the iron additive is provided in a hydrochloric acid-based pickle liquor.

11. A method as claimed in Claim 1 further comprising in the treating step adding alkali to the particulate matter.

12. A method as claimed in Claim 11 wherein the alkali is selected from the group consisting of magnesium oxide, magnesium hydroxide, high calcium quick lime, dolomitic quick lime, hydrated lime, limestone, reactive calcium carbonate, lime kiln dust, sodium silicate, sodium aluminate, cement, cement kiln dust, sodium hydroxide, sodium carbonate, sodium bicarbonate, potassium hydroxide, potassium carbonate, potassium bicarbonate, alkaline soil and a lime-containing material.

13. A method as claimed in Claim 11 wherein the alkali is added in an amount between about 0.1% and 15% by weight.

14. A method as claimed in Claim 1 further comprising after the incubating step adding alkali to the particulate matter.

15. A method as claimed in Claim 14 wherein the alkali is selected from the group consisting of magnesium oxide, magnesium hydroxide, high calcium quick lime, dolomitic quick lime, hydrated lime, limestone, reactive calcium carbonate, lime kiln dust, sodium silicate, sodium aluminate, cement, cement kiln dust, sodium hydroxide, sodium carbonate, alkaline soil and a lime-containing material.

16. A method as claimed in Claim 14 wherein the alkali is added in an amount between about 0.1% and 15% by weight.

17. A method as claimed in Claim 1 wherein the incubation step is performed at a temperature at least 10 °C higher than ambient temperature.

18. A method as claimed in Claim 17 wherein the incubation step is performed at a temperature between about 35°C and 90°C.

19. A method for reducing bioaccessibility of a heavy metal in metal-contaminated particulate matter, the method comprising the steps of:
treating the particulate matter with triple superphosphate and iron chloride additives;
saturating the additive-containing particulate matter with water;
incubating the saturated, additive-containing particulate matter at a temperature between 35 °C and 50 °C inclusive for a time sufficient to reduce the bioaccessibility of the heavy metal.

20. A method as claimed in Claim 19 further comprising adding magnesium oxide to the incubated particulate matter.

21. A method as claimed in Claim 19 wherein the triple superphosphate additive is added to the particulate matter at between 4% and 10% inclusive by weight.

22. A method as claimed in Claim 19 wherein the iron chloride additive is added to the particulate matter at between 2% and 5% inclusive by weight.

23. A method as claimed in Claim 19 wherein the incubation step proceeds for at least one day.

24. A method as claimed in Claim 19 wherein the incubation step proceeds for at least three days.

25. A method as claimed in Claim 19 wherein the incubation step proceeds for at least 6.2 days.